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IBM 1410/7010 Operating System (1410-PR-155)
Tele-Processing Supervisor—1410-SV-964

This publication contains the specifications of the TELE-PROCESSING® Supervisor, and is a supplement to the publication, *IBM 1410/7010 Operating System; System Monitor,* Form C28-0319.

The Tele-Processing Supervisor, which is generated as part of the System Monitor for the 1410/7010 Operating System, provides control facilities for programs written by an installation to process input/output for the Tele-Processing devices. Information in this publication includes a description of the basic principles of the Tele-Processing Supervisor, instructions for writing programs to operate under its control, and a discussion of the program elements that can be selected during System Generation to create a Tele-Processing Supervisor tailored to the requirements of each installation.

Contents

Purpose of This Publication

This publication contains the information necessary for use of the 1410/7010 Operating System in installations with TELE-PROCESSING® devices. Included are descriptions of the basic principles of the Operating System Tele-Processing Supervisor, instructions for writing programs to be controlled by the Supervisor, and considerations for generating a Tele-Processing system within the 1410/7010 Operating System.

Purpose of the Tele-Processing Supervisor

The Tele-Processing Supervisor (hereinafter referred to as the Supervisor) controls all programming that uses Tele-Processing devices. The Supervisor is incorporated into the Resident Monitor of the Operating System for each installation that uses Tele-Processing devices.

The Supervisor is created during System Generation according to the configuration of Tele-Processing devices specified by each installation. Thus, each installation can create a configuration of the Supervisor that is only as large as is necessary to support the particular machine configuration of the installation.

The Supervisor has facilities to support input/output for the following devices:

IBM 7750 Programmed Transmission Control

IBM 1440 Data Processing System with an attached IBM 1448 Transmission Control Unit

IBM 1414 Input/Output Synchronizer, Models 4 and 5, with one or more of the following devices attached:

IBM 1009 Data Transmission Unit

IBM 1014 Remote Inquiry Unit

Telegraph terminal units (by means of the IBM Telegraph Input/Output special feature)

NOTE: The IBM 7750 and the IBM 1440/1448 combination are referred to as Programmed Transmission Control (PTC) units. Almost all of the Supervisor's operations for these devices are identical. The few exceptions are noted in the appropriate sections of this publication. One or more of the above Tele-Processing devices is assumed to be included in an installation's machine requirements.

Prerequisite Literature

As this material supplements the publication, *IBM 1410/7010 Operating System; System Monitor,* Form C28-0319, it is assumed that the reader is thoroughly familiar with the information contained in that text.

In addition, the reader must be familiar with information presented in the publications:

IBM 1410/7010 Operating System; Autocoder, Form C28-0326

IBM 1410/7010 Operating System; Basic Input/Output Control System, Form C28-0322

The reader should also be familiar with any of the following publications that apply to his particular Tele-Processing system.

For the devices attached to the IBM 1414:

IBM 1009 Data Transmission Unit, Form A24-1039

IBM Telecommunications with IBM 1410 Data Processing System, Form A22-0525

For the IBM 7750:

IBM 7750 Programmed Transmission Control, Form A22-6679

IBM 7750 Data Control Package, Form J28-8096

For the IBM 1440/1448:

IBM 1448 Transmission Unit, Form A24-3010

Intersystem Input/Output Control System for IBM 1440/1448, Form C24-3051

Machine Requirements

Detailed information concerning the machine requirements for a Tele-Processing system within the 1410/7010 Operating System is presented in the publication, *IBM 1410/7010 Operating System; System Generation,* Form C28-0352.

Basic Principles of the Supervisor

Program Components of a Tele-Processing System

An application within the Operating System that uses Tele-Processing devices requires three major program components:

1. Supervisor
2. Programs that process input/output for TP devices
3. A communication program that performs liaison functions between the Supervisor and the programs that process the input/output

Together, these three program components compose the *TP complex* of a given installation.

The processing programs are termed *TP programs*; the program that acts as liaison between the TP programs and the Supervisor is termed the *Executive*. The Executive and the TP programs are written by each installation in accordance with the particular requirements of the installation's Tele-Processing system.

The Supervisor and the Executive permanently reside in core storage as part of the Resident Monitor. The TP programs can either reside permanently in core storage or be called from external storage (tape or disk) as they are required.

An additional programming element is related to a Tele-Processing system. This element consists of programs that are being executed during the time the installation is ready to receive input from Tele-Processing devices. (The programs are not necessarily related to the processing of that input.) These programs are called main-line programs.

For example, if a sorting program is being executed when input from a Tele-Processing device interrupts processing, control is taken from the sorting program and given to the TP complex. After the TP complex has completed its functions, control is returned to the sorting program at the point of interruption. In this example, the sorting program is considered the main-line program in relation to the TP complex. Figure 1 illustrates the core-storage relation of the various program elements within a Tele-Processing system.
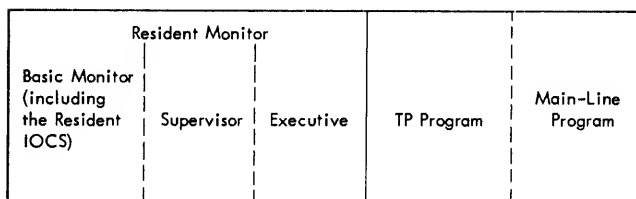
Resident Monitor				
Basic Monitor (including the Resident IOCS)	Supervisor	Executive	TP Program	Main-Line Program

Figure 1. Program Elements of a Tele-Processing System

Input Logic of the Supervisor

The functions performed by the elements of a TP complex receiving input are illustrated in Figure 2. It is suggested that the reader use the simplified block diagram as a visual reference for the text, tracing the flow of processing between the Supervisor, the Executive, and a TP program, as follows:

1. Input from a Tele-Processing device (hereinafter referred to simply as input) causes a machine interrupt.
2. Resident IOCS saves the status of the program currently being executed, and gives control to the Supervisor.
3. Supervisor reads input into an available input area.
4. Supervisor, if a main-line program was interrupted by the original input, informs the Executive that input is available in a specific input area.
5. Executive analyzes the input to determine which TP program is needed to process it.
6. Executive supplies the Supervisor with the name of the required TP program. (If it is already in core storage, the Supervisor initiates the execution of that TP program.)
7. Supervisor, if the Executive's loading directive causes the TP program to extend beyond the reserved area, first unloads onto the Temporary Storage file the entire main-line program to provide space for the TP program.
8. Supervisor, if the required TP program is not in core storage, locates and loads the TP program from the TP Library file.
9. Supervisor initiates execution of the TP program.
10. TP program completes its processing.
11. TP program returns control to the Supervisor.
12. Supervisor reloads the main-line program that was unloaded onto the Temporary Storage file.
13. Supervisor returns control to the main-line program through the Resident IOCS, which restores the status of that program and branches to it at the point of interruption.

The steps above assume that the machine interrupt occurred during the processing of a main-line program. If the interrupt had occurred during the processing of a TP program, the Supervisor would perform the following:

1. Supervisor sets a program switch, to indicate further input is available for processing.

Supervisor | Executive | TP Program

```
        ( From
          Resident
          IOCS )
            |
            v
  +--------------------+
  | 1. Determine Device.|
  | 2. Read.           |
  | 3. Check for Errors.|
  +--------------------+
            |
            v                              +-------------+
      /  TP      \        Yes              | GET Address |
     <  Program Inter- >------+            |     of      |
      \ rupted? /             |            | Input Area  |
         \  /                 |            +-------------+
          | No                |                  |
          |              +---------+             v
          v              | Set     |        +-------------+
  +-------------+        | Pending |        | Check for Error|
  | Store Address|       | Input   |        | Indicators set |
  |     of       |       | Switch  |        | by Supervisor  |
  | Input Area   |       +---------+        +-------------+
  +-------------+            |                    |
          ^                  |                    v
          |                  |              +-------------+
     /  Pro-  \              |              | Request     |
    < gram in Core >  Yes    |              | TP Program  |
     \   ?   /------+        |              +-------------+
         \ /        |        |
          | No      |        |
          v         |        |
  +-------------+   |        |         +-------------+
  | Load        |---+--------+-------->| Open        |
  | TP Program  |   |        |         | Data Files  |
  +-------------+   |        |         +-------------+
          |         |        |               |
          v         |        |               |
  +-------------+   |        |         +-------------+
  | Internal    |---+--------+-------->| Process     |
  | Housekeeping|   |        |         | the Input   |
  +-------------+   |        |         +-------------+
                    |        |               |
                    |        |               v
                    |        |         +-------------+
                    |        |         | Indicate    |
  +-------------+   |        |         | Release of  |
  | Release     |<--+--------+---------| Input Area  |
  | Input Area  |   |        |         +-------------+
  +-------------+   |        |               |
          |         |        |               v
          v         |        |         +-------------+
     /  More  \     |        |         | Close       |
    <  Input?  >----+--------+---------| Data Files  |
     \   /    Yes   |        |         +-------------+
         | No       |
         v          |
      ( Exit )<-----+
```
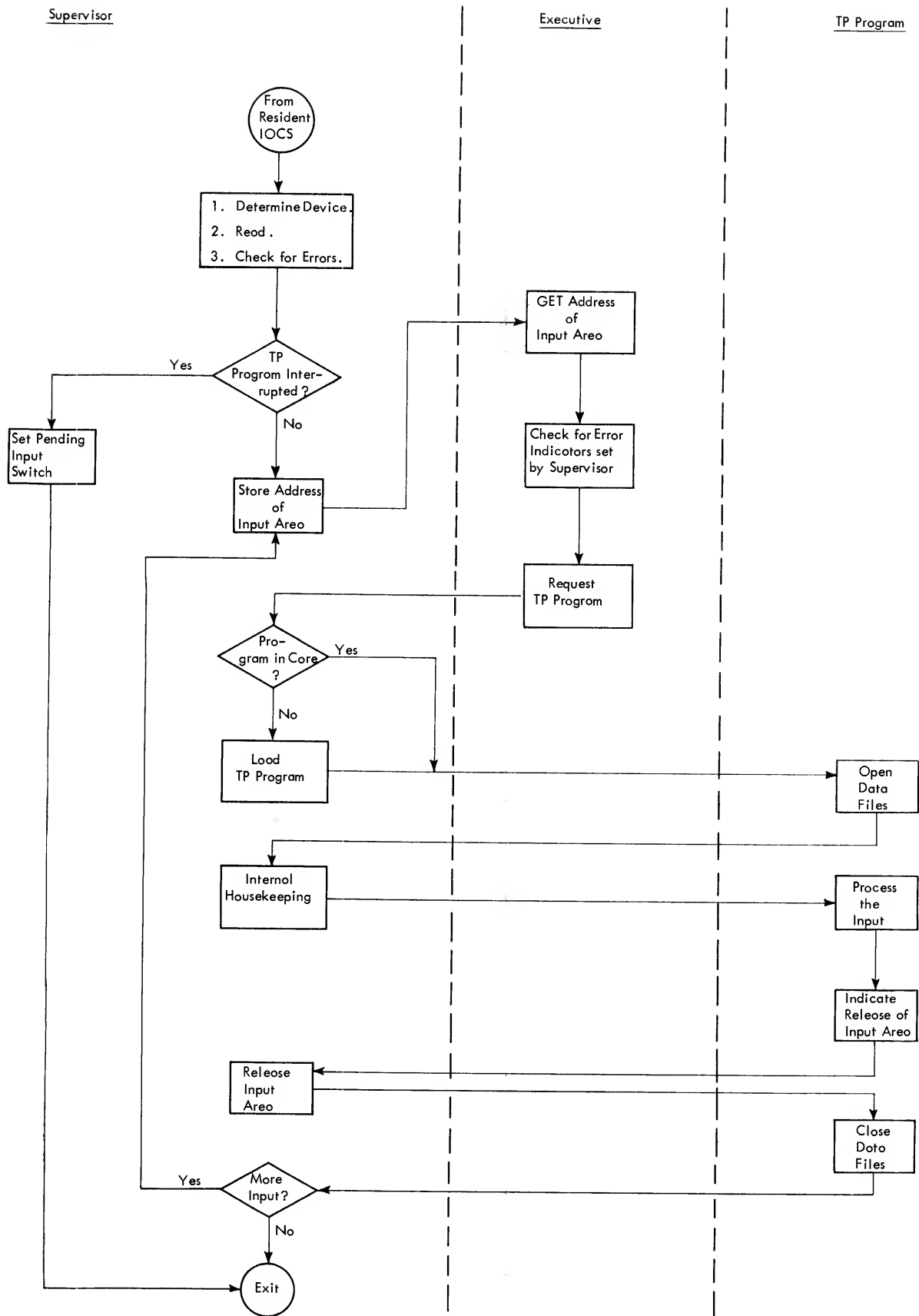
Figure 2. Input Logic

2. Supervisor returns control to the interrupted TP program. (Control is returned through the Resident IOCS, which restores the status of the interrupted TP program and branches to it at the point of interruption.)

3. Supervisor, when the TP program has completed processing, informs the Executive that further input is available.

Output Logic of the Supervisor

Requests for sending output to a Tele-Processing device can be issued to the Supervisor from TP programs, the Executive, and main-line programs by the use of linkage sequences. Figure 3 is a simplified block diagram of the functions performed when a linkage sequence is issued to one of the Supervisor's output routines. (The Supervisor has an output routine for each Tele-Processing device included in the system.)

The Supervisor performs the following:

1. Executes output routine specified by the linkage sequence. (The linkage sequence contains the address of the output area to be used.)

2. Adds the request to a list of output requests for that device.

3. Sets a word mark in the first position of the output area's control field, indicating that the area is not currently available for further use.

4. Sets a program switch in the Resident IOCS to indicate that output is ready to be written to a Tele-Processing device.

5. Branches to Resident IOCS to see if the channel is busy.

6. Resident IOCS, if the channel is busy, returns control to the instruction immediately following the linkage sequence that issued the output request. (The actual write is performed when the channel is free and the Resident IOCS checks its various program switches and lists for output requests.)

7. Supervisor, when channel is free, writes output.

8. Clears the word mark switch in the control field of the output area, after a successful write operation, to release the area for further use.

9. Supervisor, when an output area is released, returns control to the Resident IOCS.

10. Resident IOCS, after completing its current functions, returns control to whichever program was interrupted when the completion of an input/output operation initially set the channel free.

If errors occurred in the write operation, the Supervisor's routine:

    a. Sets appropriate error indicators in the control field of the output area.

    b. Branches to the Executive, which then analyzes the errors.

    c. Supervisor, in accordance with instructions supplied by the Executive, either attempts the write operation again, or ignores the write operation and releases the output area for further use.

Storage of TP Programs

TP programs are kept on a file known as the *TP Library file*. This file consists of a *TP Directory*, which speeds location and loading of the TP programs, and the TP programs themselves.

The TP Library file can be in either relocatable or absolute format. It may reside on either disk or tape, regardless of the storage medium used for other elements of the Operating System. However, if the file is on tape, it must be the only file on that tape.

At System Generation, the installation specifies the appropriate Library Generator(s) to be included on its System Operating File for the subsequent creation of the TP Library file. It also must specify the appropriate loader to be incorporated into the Supervisor (see the section, "Considerations for System Generation").

Each installation can designate a specific area of core storage (immediately above the Resident Monitor) to be reserved for TP programs only. In such a case, the most frequently used TP programs can permanently reside in the reserved area. If all of the installation's TP programs can fit into the reserved area at the same time, the TP Library file is required by the Supervisor only at those times the TP complex is initialized. However, if the installation does not reserve an area for TP programs, or if all of the installation's TP programs cannot fit into the reserved area at the same time, the TP Library file must always be available to the Supervisor.

For installations that must meet heavy demands from Tele-Processing devices, and that cannot keep the most frequently used TP programs in a reserved area of core storage, it is recommended that the TP Library file be kept in 1301 Disk Storage. This type of storage permits maximum speed in locating and loading the TP programs.

Temporary Storage File

Installations that require a TP Library file to be constantly available to the Supervisor may also require the availability of a *tape unit* to serve as a Temporary Storage file for temporary storage of main-line programs. If the location specified by the Executive for the loading of a TP program causes the TP program to extend beyond the reserved area, and the Supervisor containing facilities to unload is selected, the main-line program will be overlaid.
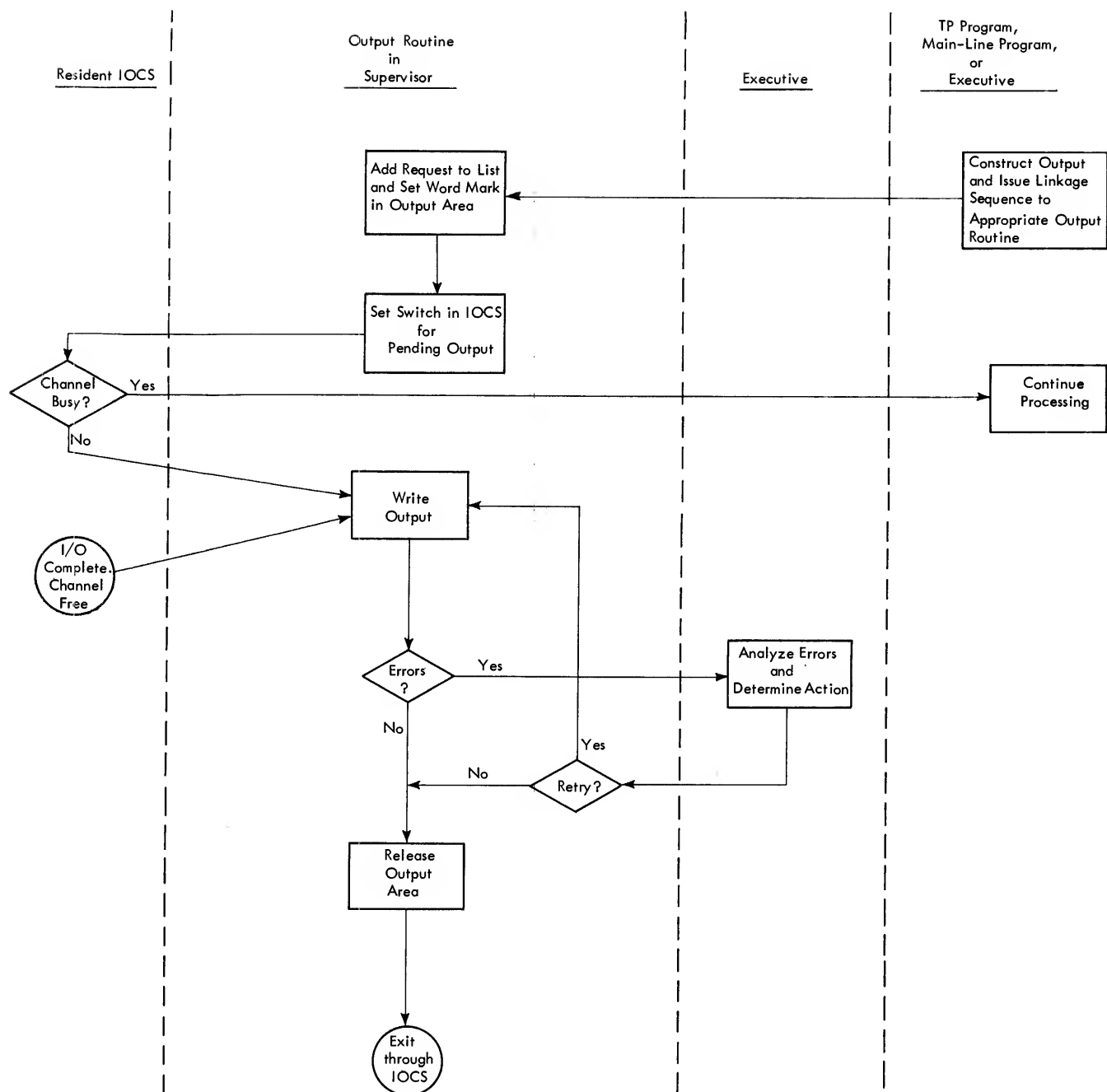
Resident IOCS

Output Routine
in
Supervisor

Executive

TP Program,
Main-Line Program,
or
Executive

Construct Output
and Issue Linkage
Sequence to
Appropriate Output
Routine

Add Request to List
and Set Word Mark
in Output Area

Set Switch in IOCS
for
Pending Output

Channel
Busy? —Yes→ Continue
Processing

No

I/O
Complete.
Channel
Free

Write
Output

Errors
? —Yes→ Analyze Errors
and
Determine Action

No

Yes

No Retry?

Release
Output
Area

Exit
through
IOCS

Figure 3.   Output Logic

The Supervisor unloads onto the Temporary Storage file the entire main-line program to provide sufficient space for the TP program. When it is time to return control to the main-line program, the Supervisor reloads it from the Temporary Storage file.

Initialization of the TP Complex

The entire TP complex, including all the files associated with Tele-Processing devices, is initialized in one operation. This operation is requested either by a Monitor control card or console inquiry directed to the Supervisor. (This initialization, which is called *opening* the TP complex, can include the loading of TP programs into core storage.) Similarly, the TP complex is *closed* by means of a Monitor control card or console inquiry.

The following Monitor control card is used to open the TP complex:

Column:	6	16	21
Contents:	MON$$	TP	AOPEN

The following Monitor control card is used to close the TP complex:

Column:	6	16	21
Contents:	MON$$	TP	ACLOSE

NOTE: The "A" in column 21 indicates this control card is directed to the Supervisor, rather than the Executive. (Information concerning control cards for the Executive is contained in the next section of this publication, "Writing the Executive," under the topic "Control Information for the Executive.")

The following messages from the console cause the Supervisor to open or close the TP complex:

    $90bAOPEN
    $90bACLOSE

The control card for opening or closing the TP complex is placed in the Standard (or Alternate) Input Unit (among Monitor control cards) anywhere after the first JOB card of a main-line program, and before the input unit's Monitor END card. A console inquiry for opening or closing the TP complex can be made at any time.

NOTE: TP Library files can only be generated with the TP complex closed.

Figures 4 and 5 are simplified block diagrams of the functions performed during opening and closing of the TP complex. Note that if the open or close is initiated by a Monitor control card, the Supervisor's *exit* is to the Transitional Monitor, since Monitor control cards are initially analyzed by that element of the System Monitor. If the open or close is initiated by a console inquiry, the Supervisor's *exit* is to the Resident IOCS, since that is the element of the System Monitor that initially accepts interrupts from the console.

The following section, "Writing the Executive," contains detailed information concerning communication between the Supervisor and Executive, including information related to opening and closing functions.
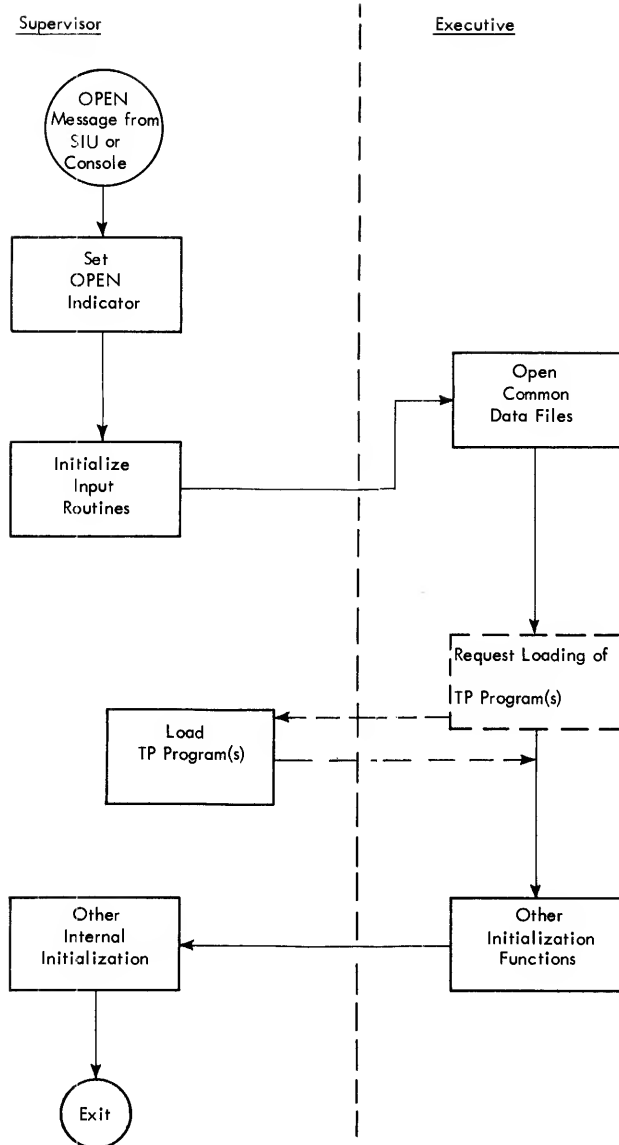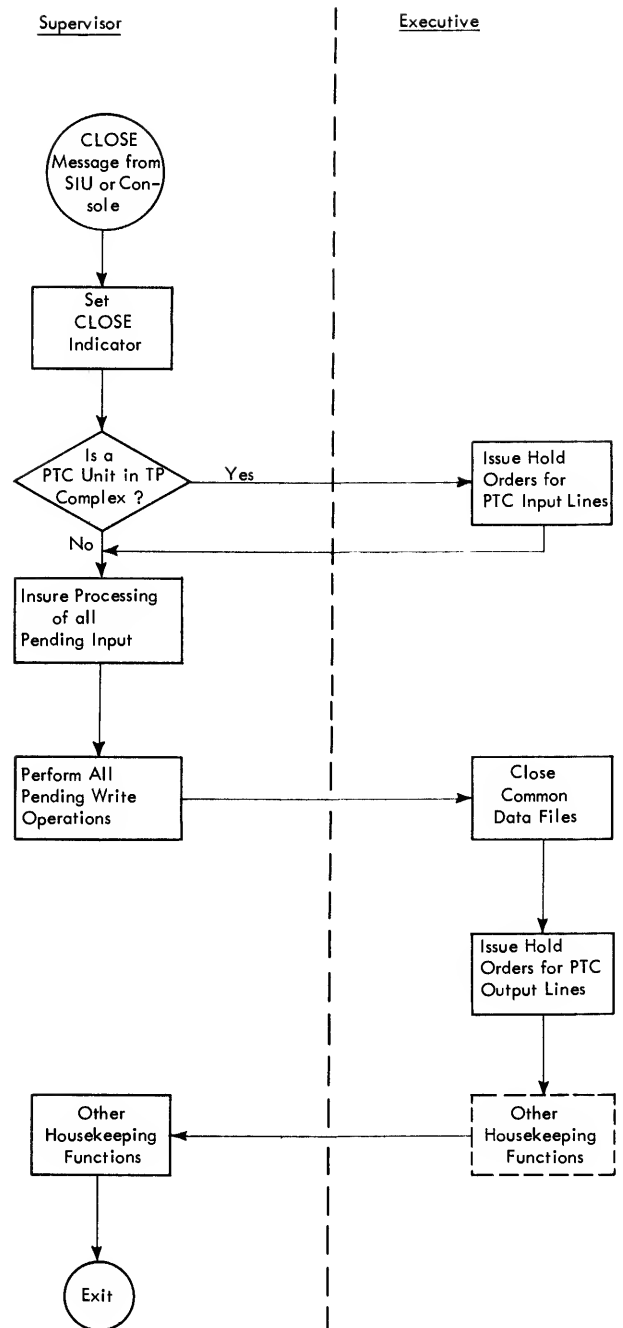
Figure 4.   Opening Functions

Figure 5.   Closing Functions

This section contains the information necessary to write an Executive that meets the requirements of the Supervisor and the installation's particular Tele-Processing system.

Since the Executive serves as a liaison between the Supervisor and the individual TP programs, certain rules of format must be observed in the creation of the Executive. For the most part, these rules involve the definition of specific linkage symbols to represent entry points and data areas within the Executive, and the use of branches from the Executive to entry points in the Supervisor (which are represented by linkage symbols and system symbols). At System Generation, the various symbols are converted by the Linkage Loader into actual machine addresses, thus establishing communication between the Executive and the Supervisor.

The procedures for establishing communication with the Supervisor, and the procedures for meeting other responsibilities of the Executive (such as the creation of input areas) are described in this section.

Responsibilities of the Executive

In its role as liaison between the Supervisor and the TP programs, the Executive must perform the functions outlined below. Note that the Executive *can* perform other functions, as determined by the requirements of its particular Tele-Processing system, but the following responsibilities *must* be met, since the Supervisor contains references to specific linkage symbols that must be established in the Executive. (The information below is a checklist of responsibilities. A list of the linkage symbols required for these functions is presented in the following topic. The remaining topics of this section provide the detailed instructions for meeting the responsibilities listed below.)

OPENING THE TP COMPLEX

The Executive must contain an entry point to which the Supervisor can branch when the TP complex is opened. At this entry point, the Executive can open data files, request the loading of TP programs, and perform other initialization functions.

INPUT TO THE TP COMPLEX

The Executive must create (and contain) all input areas for Tele-Processing devices. The Executive must supply the Supervisor with the addresses of the input areas.

The Executive must contain an entry point to which the Supervisor can branch when it has input available for processing. At this entry point, the Executive gets the address of the input area from the Supervisor, checks for error indicators set by the Supervisor, and analyzes the input to determine the TP program required to process it.

The Executive must supply the Supervisor with the name and origin point of the TP program required to process the input.

OUTPUT FROM THE TP COMPLEX

The Executive must contain an entry point to which the Supervisor can branch when an output operation is unsuccessful. At this entry point, the Executive gets the address of the output area from the Supervisor, analyzes the error indicators set by the Supervisor, and then informs the Supervisor whether the output operation should be attempted again.

CONTROL CARDS AND CONSOLE INQUIRIES

The Executive must contain entry points to which the Supervisor can branch when either control cards or console inquiries for the Executive are read by other elements of the System Monitor.

CLOSING THE TP COMPLEX

The Executive must contain an entry point to which the Supervisor can branch when the TP complex is closed. At this entry point, the Executive can close data files and perform other housekeeping functions. If the TP complex includes a PTC unit, the Executive must also contain an entry point to which the Supervisor can branch (during closing) in order to permit the Executive to issue Hold orders for the PTC unit's input lines.

Linkage Symbols to be Defined in the Executive

The following linkage symbols must be defined for entry points and data areas within the Executive. Where appropriate, the brief descriptions below include references to following areas of this publication containing more detailed information related to the use of these entry points and data areas.

NOTE: Whenever control is given to the Supervisor, the user must also exit from the priority alert mode (BXPA).

TE01/   *Input Available*

The Supervisor branches to TE01/ when it has read input into an available input area. (PTC input includes both data messages and service messages.) This branch is executed regardless of whether the input contained errors. (Detailed information concerning functions to be performed by the Executive at TE01/ is contained in a later topic of this section, "Requesting TP Programs.")

TE02/   *Output Error*

The Supervisor branches to TE02/ when an error has occurred in writing output to a Tele-Processing device. (See "Errors and Error Procedures," a later topic of this section.)

TE03/   *Opening Functions*

The Supervisor branches to TE03/ to permit the Executive to open data files (not files for Tele-Processing devices). Such files would include, for example, those used by more than one TP program. The branch to TE03/ is executed each time the TP complex is opened. At the time the data files are opened, the Executive can also request the Supervisor to load TP programs into storage. (Opening data files is discussed in a later topic of this section, "Opening and Closing Data Files." Loading TP programs during initialization of the TP complex is also discussed in that topic.)

TE04/   *Closing Functions*

The Supervisor branches to TE04/ to permit the Executive to close data files. These must be the same data files that were opened by the branch to TE03/. This branch is executed each time the TP complex is closed. (See above for reference.)

The Executive should ensure that all closing functions have been completed before returning control to the Supervisor. For example, the user must be sure that a PTC unit has completed all its processing.

TE05/   *Hold PTC Lines*

The Supervisor branches to TE05/ to permit the Executive to issue Hold orders for input lines of a PTC unit (7750 or 1440/1448). This branch is executed each time the TP complex is closed. If the Executive does not include a routine to perform this function, then this linkage symbol must be assigned to a blank character. In this case, the branch is not executed. (Control orders for PTC units are discussed in a later section of this publication, "Macro-Instructions for PTC Units," under "The IOCTL Macro-Instruction.")

TE06/   *Address of First 1014/Telegraph Input Area*

The Supervisor refers to this linkage symbol to obtain the address of the first input area for input from the IBM 1014 and/or telegraph devices. TE06/ must be defined as the low-order position of a five-character field that contains this address. If the installation's Tele-Processing system does not include the 1014 or telegraph devices, then this linkage symbol must be assigned to a blank character. (A detailed discussion of input areas is presented in a later topic of this section, "Creation and Use of Input Areas.")

TE07/   *Address of First 1009 Input Area*

This linkage symbol is used in the same manner as TE06/, except that it refers to the first input area for the IBM 1009. If the 1009 is not included in the installation, then this linkage symbol must be assigned to a blank character. (See above for reference.)

TE08/   *Address of First PTC Input Area*

This linkage symbol is used in the same manner as TE06/ and TE07/, except that it refers to the first input area for PTC units. If a PTC unit is not included in the installation, this linkage symbol must be assigned to a blank character. (See above for reference.)

TE10/   *Executive Control Cards*

The Supervisor branches to TE10/ if a control card that is read from the Standard Input Unit contains information for the Executive. If the Executive does not contain a routine to accept such control card information, this linkage symbol must be assigned to a blank character. (Control information supplied to the Executive through control cards or console inquiries is discussed in a later topic of this section, "Control Information for the Executive.")

TE11/   *Executive Console Inquiries*

The Supervisor branches to TE11/ if control information entered by means of a console inquiry is intended for the Executive. If the Executive does not contain a routine to handle such console inquiries, this linkage symbol must be assigned to a blank character.

TE12/   *Request for TP Program*

The Supervisor refers to this linkage symbol to obtain the name and the origin of the TP program that is required to process the currently available input. (The origin is the location at which the Supervisor is to begin loading the TP program.) TE12/ must refer to the low-order position of the ten-character field that the Executive uses to specify the name and origin of the required TP program. (The name of the program must be placed in the five high-order positions; the origin of the program must be placed in the five low-order positions of the field.)

TE13/   *Error Conditions*

The Supervisor branches to this linkage symbol to indicate that an error condition exists that is associated with loading the TP Library Directory or a TP program. The error condition indicator is placed at TP31/ by the Supervisor. The possible indicator characters are:

INDICATOR	CONDITION	RESULT
A	Directory failed to load.	TP complex can not be opened.
B	TP program not in the Directory.	
C	No room in memory map. (Attempted to load more programs than were requested in TPDIR macro.)	Message areas associated with program are cleared.
D	TP program failed to load.	
E	TP program exceeds core storage.	
F	TP program attempted to use a file for which there was no assignment.	

This indicator may be interrogated, placed into a message, etc., but it must not be altered. A branch (BXPA) to TP30/ returns control to the Supervisor.

The message areas will be cleared by the Supervisor after a branch to TP30/. Prior to the branch, the user may take steps to save this information.

Creation and Use of Input Areas

FORMAT AND ARRANGEMENT OF INPUT AREAS

The first eight positions of every input area are used by the Supervisor as a control field to specify information to the Executive. (This control information applies to the input currently available in the area and may not be altered by the user.) Input is read into the area beginning at the ninth position. (This portion of the input area is called the *message portion.*) Every input area must be followed by a group mark with work mark.

The input areas must be arranged in sequences such that the first area contains the address of the second, the second area contains the address of the third, and so on. (These sequences are called *chains,* and the technique of linking the areas together is known as *chaining.*)

Three types of input-area chains can be created by the Executive:

1. Input areas for the IBM 1014 and/or telegraph devices. (Input areas in this chain can receive 80-character input only.)

2. Input areas for the IBM 1009. (Input areas in this chain can receive input of any length, but each area must be defined as a multiple of 80.)

3. Input areas for PTC units. (Input areas in this chain can receive input of any length, but each area must be long enough to receive the maximum length record expected from the PTC unit.)

USE OF THE CONTROL FIELD

The Supervisor uses a word mark over the first position of the control field to indicate the availability of the input area. When the Supervisor sets a word mark in that position, it indicates that the area contains input ready for processing (or a service message from a PTC unit). When a TP program or the Executive indicates to the Supervisor that the area is available for further input, the Supervisor clears the word mark.

The first position of the control field is also used by the Supervisor to indicate the source of the input. The following alphabetic characters define the possible sources:

DEVICE (AND ADAPTER)	CHANNEL 1	CHANNEL 2
1009	A	J
1014-0	B	K
1014-1	C	L
Telegraph-0	D	M
Telegraph-1	E	N
Telegraph-2	F	O
PTC Unit	G	P
PTC Unit Macro-Instruction Error	Z	Y

NOTE: The character Z or Y indicates that a PTC macro-instruction (DUMP, LDPTC, or ENDLD) was not successfully completed.

The second and third positions of the control field are used by the Supervisor to indicate errors. (A detailed discussion of errors and error procedures is presented in a following topic of this section.)

The fourth through eighth positions of the control field are used for chaining the input areas together. The Executive establishes the addresses used for chaining; the Supervisor refers to them in order to locate the input areas for read operations.

The control field of each input area must be established as follows:

1. The first three positions must be blank.

2. The next five positions must contain the high-order address of the next input area in the chain. A word mark must be set over the first of these five characters.

Figure 6 illustrates the use of Autocoder statements to construct an input-area chain for 1014 and/or telegraph input. Lines 01, 04, and 07 define the first three positions of the control fields. (Note that the labels are indented one position to cause them to refer to the high-order position of the three-character field.) Lines 02, 05, and 08 define the five positions of the control fields that contain the chaining addresses. (Note that this portion of the last input area contains blanks to indicate that this is the end of the chain.) Lines 03, 06, and 09 define the message portion of the input area.

Line 3 5	Label 6	Operation 15 16 20	21 25 30 35 40
0 1	LABEL1	DC	@bbb@
0 2		DCW	LABEL2
0 3		DA	1X80,G
0 4	LABEL2	DC	@bbb@
0 5		DCW	LABEL3
0 6		DA	1X80,G
0 7	LABEL3	DC	@bbb@
0 8		DCW	@bbbbb@
0 9		DA	1X80,G
1 0			

Figure 6. Chaining Input Areas

RELEASE OF INPUT AREAS

Normally, TP programs direct the Supervisor to release input areas, since they are the programs that usually process the input. However, the Executive can also request the release of input areas, if it happens to be the program that determines when the data in the input area is no longer required.

The Supervisor contains two entry points for the release of input areas:

1. /T03/ (T-zero-3). A branch to /T03/ results in the release of the last input area that was processed. (The high-order address of the input area currently being processed is stored in the Supervisor in a five-character field represented by the system symbol, /TS1/. A branch to /T03/ causes the Supervisor to release that area.)

2. /T04/ (T-zero-4). A branch to /T04/ causes the Supervisor to release the input area just processed, and also results in the transfer of control to a routine in the TP program that closes any data files associated with that program. The Executive does not normally use this branch. (The functions of this branch are discussed in more detail in a later section, "Writing the TP Programs.")

The release of an input area indicates to the Supervisor that the TP complex has completed all its required functions for the last input. If no other input areas are waiting with input to be processed, the Supervisor returns control to the main-line program (by means of the Resident IOCS).

Creation and Use of Output Areas

As explained earlier in this publication, the address of an output area is specified to the Supervisor by means of a linkage sequence issued from the Executive, a TP program, or a main-line program.

LINKAGE SEQUENCES FOR OUTPUT OPERATIONS

The Supervisor contains output routines for each device included in the installation's Tele-Processing system. Output requests are issued to the output routine related to the particular device that is to transmit the output message. The following list gives the system symbol to be used in the linkage sequence for each device:

DEVICE (AND ADAPTER)	CHANNEL 1	CHANNEL 2
1009	/T10/	/T20/
1014-0	/T11/	/T21/
1014-1	/T12/	/T22/
Telegraph-0	/T13/	/T23/
Telegraph-1	/T14/	/T24/
Telegraph-2	/T15/	/T25/
PTC Unit	/T31/	/T32/

Figure 7 illustrates the use of Autocoder statements to construct a linkage sequence that makes an output request to the routine related to a PTC unit on channel 2. OUTAREA is the label assigned to the high-order position of the output area.

Line 3 5	Label 6	Operation 15 16 20	21 25 30 35 40
0 1		BXPA	/T32/
0 2		DCW	OUTAREA
0 3			

Figure 7. Linkage Sequence for an Output Request

FORMAT OF OUTPUT AREAS

The format of output areas is identical to the format for input areas: an eight-position control field, followed by the message portion, followed by a group mark with word mark. However, the five positions used for chaining are entirely under control of the Supervisor. The Executive does not specify any addresses to be placed in those positions when the output areas are created.

The Supervisor uses the word mark over the first position of the control field to indicate the availability of the output area. When a linkage sequence is issued to one of the Supervisor's output routines, the routine sets the word mark over the first position to indicate that the output area is not currently available for further use. The output routine clears the word mark after the write operation has been successfully completed, indicating that the area is available for further use.

NOTE: The program that issues an output request must always first check for the presence of a word mark over the first position of the output area to be used. This is the only way to determine whether the area contains output that has not yet been written.

The first position of the control field is also used to identify the device to which the output is to be written. The Supervisor places the alphabetic character representing the device into this position. (The characters for the various devices are listed in the previous topic, "Creation and Use of Input Areas.")

The second and third characters of the control field are used by the Supervisor to indicate errors, if any, resulting from the write operation. (Detailed information is presented in the topic, "Errors and Error Procedures.")

The fourth through eighth positions of the control field are used by the Supervisor's output routines to chain the output areas together (in accordance with the sequence of output requests for that particular device). Programs that issue output requests to Tele-Processing devices should not alter the contents of these positions.

The control field of each output area must be established as follows:

1. The first three positions must be blank.

2. The next five positions must be blank, with a word mark over the first of these five positions. (These positions are used for chaining output requests.)

Requesting TP Programs

The following discussion applies to the loading of TP programs *after* the TP complex has been opened. (Instructions for loading programs *during* the opening of the TP complex are included in a later topic of this section, "Opening and Closing Data Files.")

When the Supervisor has input ready for processing, it places the high-order address of the current input area into a five-character field represented by the system symbol /TS1/. (This symbol refers to the low-

order position of the five-character field.) The address in this field remains unchanged until the input area is released.

After placing the input-area address into the TS1 field, the Supervisor branches to the entry point in the Executive represented by the linkage symbol, TE01/. The Executive analyzes the input to determine which TP program is required to process it. (This analysis includes checking the control field of the input area for error indicators.) The Executive then places the name and origin of the required TP program into a ten-position field represented by the linkage symbol, TE12/. After placing the name and origin into that field, the Executive branches to the Supervisor at the entry point represented by the linkage symbol, TP02/ (TP-*zero*-2). This branch causes the Supervisor to locate the required TP program, load it (if it is not already in core storage), and then initiate its execution.

NOTE 1: The above discussion is based on the assumption that the input was free of errors, or that the Executive chose to ignore the errors.

NOTE 2: The above discussion assumes that if the input was from a PTC unit, the input was a data message, rather than a service message.

Errors and Error Procedures

ERROR INDICATORS

The second and third positions in the control fields of both input areas and output areas are used by the Supervisor to set error indicators.

Indicators in the Second Position: The following list gives the indicators that can be set in the second position of the control field. These indicators are set for unsuccessful operations with PTC units, other than normal read and write operations.

OPERATION	CHANNEL 1	CHANNEL 2
Sense Read	A	J
Write Dynamic Load	B	K
Write Dump Parameter	C	L
Read Dumped Data	D	M

NOTE: For 1414 operations, the second position is used to provide a warning of possible machine trouble. If a "1" (for channel 1) or a "2" (for channel 2) is set in this position of an input area, it means that five *false interrupts* have occurred on that channel. (An interrupt is considered *false* when the Supervisor has checked every buffer in the 1414 and found that none of them contains input.)

Indicators in the Third Position: The following list contains the indicators that can be set in the third position of the control field. Indicators that are set only for operations with PTC units are designated in this list by the notation "PTC"; indicators set only for operations with the 1414 are designated by "1414"; indicators that can be set for either type of device are designated by "Both."

DEVICE	INDICATOR	ERROR
PTC	1	Invalid control information was received.
PTC	2	Output to the PTC was longer than maximum specified buffer; or read operation from the PTC was terminated by the computer before PTC reached end of record.
PTC	3	Output queue of the channel designated in the message just written is full. No more output messages for this channel should be sent to the PTC until the PTC sends a service message indicating the queue is available.
PTC	4	The channel designated in the output message just sent to the PTC is in Hold status.
Both	5	1410/7010 I/O channel parity error.
PTC	6	The operation in progress was terminated before completion because the channel failed to respond to a service request.
1414	7	Wrong-length-record error.
1414	8	Error between 1414 buffer and terminal unit.
1414	9	Error between 1414 buffer and the computer.
Both	A	Device is not ready.
PTC	C	Condition check.
PTC	D	No transfer.
1414	E	Substitute record message from 1009.

INPUT ERROR PROCEDURES

If error indicators are set in the control field of an input area, the Executive analyzes the errors and determines whether the input can be accepted. If the Executive determines that the input can be used, it issues a request to the Supervisor for the TP program required to process the input. If the Executive determines that the input is not acceptable, the Executive's input-error procedures must be terminated by returning control to the Supervisor at the entry point represented by system symbol, /T03/. This branch releases the input area for further use.

The Executive's error procedures could include such functions as writing messages to the operator and placing the unacceptable input on a file specified for this purpose.

Although it is recommended that error procedures be written as part of the Executive, it is permissible to write the error procedures in the form of a TP pro-

gram. Such a program can be requested by the Executive in the same manner as TP programs that perform normal processing functions. However, it should be noted that this procedure requires extra time, which is usually a critical factor in Tele-Processing systems.

OUTPUT ERROR PROCEDURES

When an error occurs in an output operation for a Tele-Processing device, the Supervisor sets the appropriate error indicator(s) in the control field of the output area associated with the error. The Supervisor also places the high-order address of the output area into a five-character field represented by the system symbol, /TS2/. (The symbol /TS2/ refers to the low-order position of this five-character field.) The Supervisor then branches to the entry point of the Executive represented by the linkage symbol, TE02/.

NOTE: The instruction located at the entry point must be a Store B-Address Register (SBR). That is, the linkage symbol must be defined as representing the operation code of this instruction. (This can be accomplished by means of the normal Autocoder labeling technique, in combination with an Autocoder DEFIN statement.)

The Executive, in addition to performing any error functions, such as writing a message to the operator, indicates to the Supervisor whether the output request should be cancelled or whether the write operation should be attempted again. This indication is given by means of the word mark over the first position of the output area's control field. If the Executive leaves the word mark set, the Supervisor will initiate a retry of the write operation. If the Executive clears the word mark, the Supervisor will cancel the output request and release the output area for further use.

The Executive's output-error procedures must be terminated by returning control to the Supervisor at the address that was stored by the Store B-Address instruction. The Supervisor then checks for the word mark over the first position of the output area's control field, and proceeds accordingly.

Opening and Closing Data Files

If the TP complex requires data files that are used by more than one TP program, it is advantageous to have the routines for opening and closing those files incorporated into the Executive. (The Executive must also include the DTF statements for the files.) This eliminates the need for each TP program to duplicate the opening and closing of these common files. Furthermore, the Executive itself could require data files. For example, a file used to record unacceptable input would normally be under the control of the Executive.

For these opening and closing functions, the Executive contains two entry points, which are represented by the linkage symbols, TE03/ (for opening functions) and TE04/ (for closing functions). Each time the TP complex is opened, either by control card or console inquiry, the Supervisor branches to TE03/. Each time the TP complex is closed, the Supervisor branches to TE04/. The instruction represented by each of these linkage symbols must be a Store B-Address instruction, to provide for the return to the Supervisor at the completion of the opening or closing functions.

NOTE: If the installation's Executive does not perform opening or closing functions, the linkage symbols must still be assigned to entry points in the Executive. In this case, the Store B-Address instruction can place the B-address into the next sequential instruction, which would be a branch instruction. This would effect an immediate return to the Supervisor.

LOADING TP PROGRAMS DURING OPENING OF THE TP COMPLEX

When the Supervisor branches to the Executive at TE03/, the Executive can, in addition to opening data files, request the Supervisor to load TP programs in core storage.

The Executive places the name and origin of the requested TP program into TE12/, as in the case of requesting TP programs *after* the TP complex has been opened. (See previous topic, "Requesting TP Programs.") The Executive then branches to the Supervisor at TS99/. The Supervisor loads the requested program from the TP Library file and returns control to the Executive at the instruction immediately following the branch to TS99/. The Executive can repeat this procedure for each TP program that is to be loaded during the opening of the TP complex.

NOTE: Entry to the Supervisor at TS99/ may be made *only* during opening of the TP complex.

Control Information for the Executive

In addition to the type of control information that is supplied to the Executive by the Supervisor, the Executive can also receive control information from control cards placed in the Standard (or Alternate) Input Unit and from console inquiries by the operator.

CONTROL CARDS FOR THE EXECUTIVE

Control cards directed to the Executive use the same format as the control cards for opening and closing the TP complex:

Column:	6	16	21
Contents:	MON$$	TP	Information for the Executive

NOTE: Column 21 must not contain the alphabetic character A. The presence of an A in column 21 indicates that the control card is directed to the Supervisor. (This applies only to Monitor control cards with TP in columns 16-17.)

When the Supervisor is informed by the Transitional Monitor that a control card directed to the TP complex has been read, the Supervisor checks column 21 for an A, in order to determine whether the card is directed to the Supervisor (for opening or closing the TP complex). If column 21 does not contain an A, the Supervisor branches to the Executive at the entry point represented by the linkage symbol, TE10/. (The high-order address of the input area containing the card is stored in a five-character field in the Communication Region of the Resident Monitor. The system symbol /CRD/ refers to the low-order position of this five-character field.)

The instruction located at the entry point represented by the symbol TE10/ must be a Store B-Address Register instruction. After processing the control card, the Executive must return control to the Supervisor at the address stored by this instruction.

Control cards for the Executive can be placed in the Standard (or Alternate) Input Unit immediately preceding either a JOB card or the input unit's END card.

CONSOLE INQUIRIES FOR THE EXECUTIVE

Console inquiries directed to the Executive use the same format as the console inquiries for opening and closing the TP complex:

$90bXXXXXXX

The information for the Executive, represented above by xxxxxxx, must not exceed 16 characters, making a maximum message length of 20 characters. Also, the first character of the information for the Executive (the fifth character of the total message) must not be an A. The presence of an A in this position indicates that the message is directed to the Supervisor for either opening or closing the TP complex.

When the Supervisor is informed by the Resident Monitor that a console message directed to the TP complex has been read, the Supervisor checks the fifth character of the message for an A. If the fifth character is not an A, the Supervisor branches to the Executive at the entry point represented by the linkage symbol, TE11/. The first position of the total message is at the location represented by the linkage symbol, /RIQ/.

The instruction located at the entry point represented by the linkage symbol TE11/ must be a Store B-Address Register instruction. After processing the console message, the Executive must return control to the Supervisor at the address stored by this instruction.

Service Messages from PTC Units

Service messages from PTC units are treated by the Supervisor in the same manner as data messages from those units. After the Supervisor informs the Executive that input is available (by a branch to the Executive's entry point, TE01/), it is the Executive's responsibility to analyze the input to determine whether it is a service message.

NOTE: Service messages have priority over data messages.

Any actions required to respond to the service message, such as issuing a control order to the PTC unit, should be performed by the Executive, rather than by a TP program. (As in the case of error procedures, response by the Executive requires the least time. "Macro-Instructions for PTC Units" contains information concerning control orders.)

The service messages that can be issued by PTC units are listed below. Descriptions of these service messages are included in the publications that describe the control programs for PTC units. (The machine-language format of each service message follows the name of the message.)

Process Storage Parity Error (7750 only) — X1nnnn
Control Storage Parity Error (7750 only) — X2nnnn
Full Word Transfer Error (7750 only) — X3nnnn
High Speed Channel Error — Y1xxnnnn
Channel Placed in Hold (Machine-Detected Error) — Y2xx
Channel Placed in Hold (Control Response) — Y3xx
Channel Placed in Hold (Program-Detected Error) — Y4xx
Channel Queue Available — Z1xx

The macro-instructions in this section can be used for programming related to PTC units. These macro-instructions are incorporated into programs by the Autocoder processor.

The IOCTL Macro-Instruction

This macro-instruction causes control orders to be sent to a PTC unit. Nine different operands can be used with this macro-instruction for specifying various control orders. It is recommended that this macro-instruction, in its various forms, be issued by the Executive.

The first operand of the IOCTL must be the number of the channel to which the PTC unit is attached. The second operand must be the Autocoder mnemonic for the particular control order. This mnemonic must be followed by the two-character identification of the appropriate communication channel. (This identification, indicated in the following list by xx, is not used for the control orders, SETTIME and SETINTV.) Other required operands are noted in the descriptions of the control orders to which they apply.

The following list contains the nine Autocoder mnemonics for the control orders, the function of each control order, and the machine-language format of the control order.

KILLMSG, xx

This order is used to cancel any messages stacked in the PTC for transmission over a channel that has been placed in Hold status by the PTC unit. It must not be given until one of the Channel Placed in Hold (error) service messages is sent by the PTC unit, even though an unusual end on a previous write operation may have been the first indication that a channel was held. This entry generates an order with a format of 37xx.

RETNMSG, xx

When a channel has been placed in Hold status by the PTC unit, any messages stacked for that channel will be transferred from the PTC unit as input messages when the RETNMSG order is given. As with the KILLMSG order, it must not be given until one of the Channel Placed Into Hold (error) service messages is received. This entry generates an order with a format of 33xx.

HOLDNOW, xx

This order immediately places the specified communication channel in Hold status, regardless of whether there are any queued messages. This entry generates an order with a format of 31xx.

HOLDCLR, xx

This order causes transmission of any messages in the specified PTC channel queue and then puts the channel in Hold status. This entry generates an order with a format of 38xx.

NOTE: Each time the TP complex is closed, the Supervisor branches to an entry point in the Executive (represented by the linkage symbol, TE05/) to enable the Executive to issue Hold orders for PTC units. (See the list of linkage symbols included in the earlier section, "Writing the Executive.") The instruction at the location represented by TE05/ must be a Store B-Address Register instruction to provide for returning control to the Supervisor. Following this SBR instruction, the Executive can issue IOCTL macro-instructions with operands of HOLDNOW and/or HOLDCLR.

SETFREE, xx

This order frees the specified channel from Hold status and allows message reception or transmission to take place. This entry generates an order with a format of 34xx.

SETERCT, xxyyy

The error count for the specified channel is set to the value specified by this order. When the error count reaches zero, the channel is placed in Hold status. In the above format, xx indicates the channel number and yyy specifies the error count value, which can be any value except 000. The error count must be an octal number if the control order is sent to the 7750, and a decimal number if the control order is sent to the 1440/1448. This entry generates an order with the format of 71xxyyy.

SETTIME, hhmmq

This order, which is used only for the 7750, causes the 7750 to reset the time clock to the value specified by hhmmq. The first and second characters, hh, specify the hours; the third and fourth, mm, specify the minutes; and the fifth, q, specifies the quarter-minute (0, 1, 2, or 3). No channel is specified for this order. This entry generates an order with a format of 77hhmmq.

SETINTV, iiii

This order, which is used only for the 7750, causes the 7750 to set the interval timer to the number of 15-second intervals specified by iiii. A 0000 entry turns off the interval timer. No channel is specified. This entry generates an order with a format of 73iiii.

SUBCHAN, xxyy

This order substitutes one low-speed channel for another when a channel is placed in Hold status because of machine-detected errors. In the entry, xx indicates the old channel; yy specifies the new one. The following requirements must be met for the SUBCHAN control order to work properly:

1. The channel being replaced must be in Hold status when the control order is given. No check is made for the status of channel yy.

2. The new channel (yy) must be the same type as the old channel (xx). For example, a full duplex channel must be substituted for a full duplex channel, and the two channels must be the same speed.

3. For transmission to proceed on the new channel, the SUBCHAN control order must be followed by a SETERCT for the new channel, and then a SETFREE for that channel.

The LDPTC Macro-Instruction

This macro-instruction is used to load information into a PTC unit while that unit is operating, as opposed to the initial loading of the unit. (Loading a PTC unit while it is in operation is termed *dynamic* loading.)

The first operand of this macro-instruction must be the number of the channel to which the PTC unit is attached. The second operand must be the high-order address of the core-storage area from which the information is to be sent to the PTC unit. In Figure 8, which illustrates the format of the LDPTC macro-instruction, the label LOADAREA represents this address.

Line 3 5	Label	Operation 16 20	21 25 30 35 40
0.1.		L,D,P,T,C	2,,,L,O,A,D,A,R,E,A,
0.2			

Figure 8. Format of the LDPTC Macro-Instruction

After the information has been sent to the PTC unit from core storage, control is returned to the program that issued the LDPTC macro-instruction. If more information is to be sent to the PTC unit, another LDPTC must be issued. The last LDPTC must be followed by an ENDLD macro-instruction.

The ENDLD Macro-Instruction

This macro-instruction is used to terminate a dynamic load of a PTC unit. ENDLD causes a control order to be sent to the PTC unit to indicate that the PTC unit is to resume its normal processing functions. The ENDLD must be issued after the last LDPTC macro-instruction, and before any other macro-instruction that causes a control order to be sent to the PTC unit (such as one of the forms of the IOCTL macro-instruction). Any control order received by the PTC unit between a LDPTC and an

ENDLD will be treated as an ENDLD, and the PTC unit will issue an unusual end for that control order. Figure 9 illustrates the coding entry for the ENDLD macro-instruction. The operand specifies the channel to which the PTC unit is attached.

Line 3 5	Label	Operation 16 20	21 25 30 35 40
0.1.		E,N,D,L,D	2
0.2			

Figure 9. The ENDLD Macro-Instruction

The DUMP Macro-Instruction

This macro-instruction is used to unload into core storage all or a portion of the information in PTC storage. The first operand of this macro-instruction must be the number of the channel to which the PTC unit is attached. The second operand is the high-order address of an area in core storage than contains parameters defining the area of PTC storage to be unloaded. (For the 7750, the parameters consist of 16 octal characters, followed by a group mark with word mark, left-justified in the 7750 limit word format. The parameters for the 1440/1448 consist of three BCD characters, followed by a group mark with word mark, in 1401/1440 address format.)

The third operand of the DUMP macro-instruction is the high-order address of an area in core storage into which the information from PTC storage is to be read. In Figure 10, which illustrates the format for the DUMP macro-instruction, PARAMAREA represents the high-order position of the area containing the parameters for the DUMP, and DUMPAREA represents the high-order address of the area into which the information from PTC storage is to be read.

Line 3 5	Label	Operation 16 20	21 25 30 35 40
0.1.		D,U,M,P,	2,,,P,A,R,A,M,A,R,E,A,,,D,U,M,P,A,R,E,A,
0.2			

Figure 10. Format of the DUMP Macro-Instruction

The LDDCP Subprogram

This programming, because of the nature of its function, is provided as a relocatable subprogram, rather than as a macro-instruction. It is incorporated into a program during processing by the Linkage Loader, rather than during an Autocoder compilation.

The LDDCP subprogram is used for the initial loading of a PTC unit (Data Control Package for the 7750, Intersystem IOCS for the 1440/1448, or equivalent programs written by the installation). Since the programming required to initially load a PTC unit is not needed

during the time the unit is ready to receive input, it is recommended that the LDDCP subprogram be used as the nucleus of a main-line program. This program can be executed prior to opening the TP complex (by means of a Monitor EXEQ card), and thus, the instructions required to load the PTC unit are in core storage only when needed.

The LDDCP subprogram contains three entry points, represented by the following linkage symbols:

TLD0/ (TLD-zero)

A branch to TLD0/ causes the initialization of the LDDCP subprogram, and also causes it to issue (through the console printer) a message telling the operator to ready the PTC unit. Control is returned to the instruction immediately following the branch to TLD0/.

TLD1/

A branch to TLD1/ causes a write operation to the PTC unit. This branch instruction must be immediately followed by a five-character field containing the high-order address of the area from which the data is to be sent to the PTC unit. Control is returned to the instruction immediately following the five-character field.

NOTE: The LDDCP subprogram sends to the PTC unit all information in the specified area, from the high-order location up to the terminating group mark with word mark. Therefore, the program using the LDDCP subprogram must ensure that the group mark with word mark is properly set for records of varying length.

TLD2/

A branch to TLD2/ indicates to the LDDCP routine that loading of the PTC unit has been completed. This branch causes the routine to reset certain indicators in the Supervisor that had been altered in order to facilitate loading the PTC unit. Control is returned to the instruction immediately following the branch to this entry point.

The LDDCP subprogram is placed on the System Library file at the time of System Generation. The name TPLDDCP1 is used to call it for incorporation into a program that loads a PTC unit on channel 1; the name TPLDDCP2 is used for channel 2. Figure 11 is a simplified coding example showing the use of this subprogram for loading a 7750 on channel 2.

Line	Label	Operation	21 25 30 35 40
0,1		CALL	TPLDDCP2
0,2	START	BXPA	TLDO/
0,3		GET	DCPFILE
0,4		BXPA	TLD1/
0,5		DCW	AREALABEL
0,6		GET	DCPFILE
0,7		BXPA	TLD1/
0,8		DCW	AREALABEL
0,9		BXPA	TLD2/
1,0		B	/EOP/
1,1		END	START
1,2			

Figure 11. Sample Coding for the LDDCP Macro-Instruction

Line 01 calls the LDDCP subprogram (during processing by the Linkage Loader). (Note that a Linkage Loader CALL card could be used instead.) Line 02 causes the initial entry to the LDDCP subprogram. Line 03 is the standard IOCS macro-instruction that causes reading of the file that contains the Bootstrap, Loader, and Data Control Package. (This file is represented in the example by the name, DCPFILE.) Line 04 causes a branch to the LDDCP subprogram to send to the 7750 the information just brought into storage by the GET macro-instruction. Line 05 creates an address constant of the high-order address of the area containing that information (represented in the example by AREALABEL). Lines 06-08 repeat the functions of lines 03-05. (These functions are repeated as many times as necessary to send all the elements of DCPFILE to the 7750.) Line 09 causes the final entry to the LDDCP subprogram to terminate the loading process and reset the Supervisor. Line 10 is the Normal-End-of-Program branch to return control to the Resident Monitor. Line 11 is the Autocoder END statement, indicating that this subprogram is a *primary* subprogram. (The LDDCP subprogram is a *secondary* subprogram.)

If an error occurs during loading, the LDDCP subprogram types a message on the console printer indicating that the loading procedure must be started again. After the operator restarts the PTC unit, control is again returned to the instruction immediately following the branch to TLD0/.

Writing the TP Programs

The individual TP programs, like the Executive, must follow certain rules of format to permit the establishment of effective linkages between all the elements of the TP complex. This section defines some of the functions that can be performed by TP programs, and the format required for the performance of those functions.

Format of TP Programs

Every TP program must include the following sequence of instructions:

SBR — for return to Supervisor
B — to routine to open this program's data files
SBR — for return to Supervisor
B — to routine to close this program's data files
First instruction for processing the input (or a branch to that instruction).

During compilation of the TP program, the source statements must specify that the location of the first SBR instruction in the above sequence is the initial entry point for the program. This can be accomplished by using an Autocoder END card, with an operand containing the label assigned to that first SBR instruction. (Note that the required instructions need not be the first instructions in the TP program.)

When the TP program is processed by the Linkage Loader, a control record is created, which gives the Supervisor the address of the first SBR instruction in the above sequence. From this address, the Supervisor calculates the location of the other instructions in the sequence.

The TITLE card for a TP program can contain a ten-character name. However, to reduce the size of the TP Directory, only the first five characters will be recognized and incorporated. These same five characters must be the characters placed in the field TE12/ when requesting a TP program.

OPENING AND CLOSING DATA FILES

After the Supervisor has been instructed by the Executive to initiate execution of a particular TP program, the Supervisor branches to a routine in the TP program to enable that program to open any data files that it requires. (The files are opened by use of the IOCS macro-instruction IOCTL OPEN.) After completing any required opening functions, the TP program returns control to the Supervisor at the address stored by the SBR instruction immediately preceding the branch to

the opening routine. (Refer to the above sequence of instructions.) Control is then returned to the TP program for its processing functions.

When the TP program has completed its processing, it returns control to the Supervisor. This return can be made at one of three entry points in the Supervisor:

1. /T03/. A branch to /T03/ causes only the release of the input area.

2. /T04/. A branch to /T04/ causes the release of the input area, and also causes the Supervisor to return control to the TP program to close its data files.

The return caused by /T04/ is made at the second SBR instruction in the TP program's required sequence of instructions. (Refer to the preceding required instruction sequence.) After closing its data files, the TP program returns control to the Supervisor at the address stored by that SBR instruction.

NOTE 1: If a TP program completes its processing with a branch to /T03/, and further input requires the Supervisor to bring another TP program into storage, the Supervisor determines whether the second TP program must overlay the first. If such an overlay will occur, the Supervisor returns control to the first TP program to close its data files before the second TP program is brought into core storage. The Supervisor also makes this check before reloading a main-line program from the Temporary Storage file.

NOTE 2: If the TP program does not open and close any data files, then the SBR instructions can place the B-address into the branch instructions immediately following them. This effects immediate return to the Supervisor.

3. /T05/. A branch to /T05/ indicates that another TP program is required to complete the processing of the *current* input. Before the branch is made to /T05/, the name and origin of the required TP program must be placed into TE12/.

The branch to /T05/ does not cause release of the current input area. In the event that the TP program requested by the branch to /T05/ will overlay the first TP program, the Supervisor returns control to the first TP program to close its data files.

Under some circumstances, a TP program may need to ensure that its output has been written before control is returned to the Supervisor at one of the three entry points above. Specifically, if an area containing output for a Tele-Processing device is contained within a TP program, and if that TP program is subject to being

overlaid, then the program should not return control to the Supervisor until the word mark has been cleared from the first position of the output area's control field. The check for this word mark could be made in the TP program's closing routine, since the Supervisor always branches to that routine before overlaying the TP program.

ENTRY POINT FOR PROCESSING THE INPUT

After the necessary preliminary functions are completed, such as opening data files, the Supervisor initiates execution of the TP program's processing functions. This control is given to the TP program at the last instruction in the program's required sequence of instructions.

Completion of a TP Program

As explained in the above information concerning the closing of data files, a TP program returns control to the Supervisor when it has completed processing the last input (and closed its data files, if necessary). The Supervisor then determines whether more input is available. If more input is available, the Executive informs the Supervisor which TP program is required to process it. In the event that the input is to be processed by the TP program just completed, the Supervisor again initiates execution of that program, including reopening the data files, if necessary.

Special Considerations for TP Programs

1. While a TP program is processing input, the input area it is using is not available. This consideration is especially important for input from the IBM 1009, which could be lost if input areas are not made available quickly enough to handle the speed and record length used by the installation. Because of this consideration, messages to and from the IBM 1009 should not exceed 160 characters, including double pound signs (# #) on output messages. (However, depend-

ing upon the user's hardware configuration, application, and transmission rate, the device module for the IBM 1009 can handle messages of more than 160 characters.)

2. In addition to addressing its own data files, and common data files controlled by the Executive, a TP program can use the Print routine and the Punch routine, which are contained in the Resident Monitor. These routines write output to the Standard Print Unit and the Standard Punch Unit. (Instructions for using these routines are contained in the publication, *IBM 1410/7010 Operating System; System Monitor,* Form C28-0319.)

NOTE: The Standard Print Unit and Standard Punch Unit are used by main-line programs (such as a compiler), and output from a TP program will be intermixed with output from main-line programs. It is possible that a main-line program could be interrupted during a series of output operations (such as Autocoder's creation of a program listing), and output from a TP program could be placed in the middle of the main-line program's output records.

The Read routine of the Resident Monitor, which reads from the Standard Input Unit, cannot be used by any program initiated by a machine interrupt. (This includes both the Executive and TP programs.)

3. The requirements that must be met by all dependent programs within the Operating System also apply to TP programs.

4. TP programs must consist of only one phase, that is, all programming that constitutes a given TP program must be loaded into core storage at one time.

5. The TP Supervisor can operate with systems containing a maximum of 400 TP programs.

6. Relocatable programs must always start at an even-hundred address in core storage. For example, the address specified by the five low-order positions of the field TE12/ (i.e., the origin of the program) must be a multiple of one hundred.

Considerations for System Generation

At System Generation, the various elements of the TP complex are linked together, and the necessary linkages and control information for the System Monitor are generated. This section contains information concerning the various program elements that can be specified during System Generation for the creation of a TP complex. Detailed instructions for System Generation are contained in the publication *IBM 1410/7010 Operating System; System Generation,* Form C28-0352.

Modularity of the TP Complex

For purposes of System Generation, the various elements of the TP complex are considered to be program modules. A module consists of programming related to the performance of a specific group of functions, such as input/output scheduling for a particular Tele-Processing device. The name of each module is used at System Generation to specify its inclusion in the installation's Supervisor.

This concept of modularity is illustrated by the following list of modules and their functions within the Supervisor.

NAMES AND FUNCTIONS OF THE MODULES

TPSTARTCH1: Provides linkage between the Resident IOCS and the various modules required for Tele-Processing devices attached to a channel-1 1414.

TPSTARTCH2: Same as the one above, except that it applies to channel 2.

TPENDCH1: Provides linkage between the Supervisor and the various modules required for Tele-Processing devices attached to a channel-1 1414.

TPENDCH2: Same as the one above, except that it applies to channel 2.

TP1009CH1: Contains input/output routines for a 1009 attached to a channel-1 1414.

TP1009CH2: Same as above, except for channel 2.

TP1014CH10: Contains input/output routines for a 1014 (adapter 0) attached to a channel-1 1414.

TP1014CH11: Same as above, except for adapter 1.

TP1014CH20: Contains input/output routines for a 1014 (adapter 0) attached to a channel-2 1414.

TP1014CH21: Same as above, except for adapter 1.

TPTELCH10: Contains input/output routines for a telegraph unit (adapter 0) attached to a channel-1 1414.

TPTELCH11: Same as above, except for adapter 1.

TPTELCH12: Same as above, except for adapter 2.

TPTELCH20: Contains input/output routines for a telegraph unit (adapter 0) attached to a channel-2 1414.

TPTELCH21: Same as above, except for adapter 1.

TPTELCH22: Same as above, except for adapter 2.

TPPTCCH1: Contains input/output routines for a channel-1 PTC unit. (Control is retained in the module until a read or write operation is completed.) This module also provides linkage between the Resident IOCS and the PTC input/output routines.

TPPTCCH2: Same as above, except that it applies to channel 2.

TPSUPER: Contains the core of the Supervisor. It is used in a TP complex that does not require temporary storage of the main-line program to provide space in core storage for TP programs.

TPSUPERDR: Same as the one above, except that it is used for a TP complex that requires facilities to temporarily unload a main-line program in order to provide core-storage space for TP programs.

TPSUPERTPO: Contains the core of the Supervisor for TP only. It is the same as TPSUPER except for the following:

1. Contains a special waiting loop.
2. Loads TP programs from the top of the Supervisor to the end of core storage (see the section, "TP Only").

TPTAPELDRA: Contains the routine for loading absolute format TP programs for a TP Library file stored on tape.

TPTAPELDRR: Contains the routine for loading relocatable format TP programs from a TP Library file stored on tape.

TPDISKLDRA: Contains the routine for loading absolute format TP programs from a TP Library file stored on disk.

TPDISKLDRR: Contains the routine for loading relocatable format TP programs from a TP Library file stored on disk.

SELECTION OF THE MODULES

To properly generate a particular configuration of the Supervisor, certain rules of sequence must be observed. Figure 12 is a schematic representation of the proper order of the Supervisor's various modules. Note that the input/output modules form four lines between the Resident IOCS and the core of the Supervisor. These
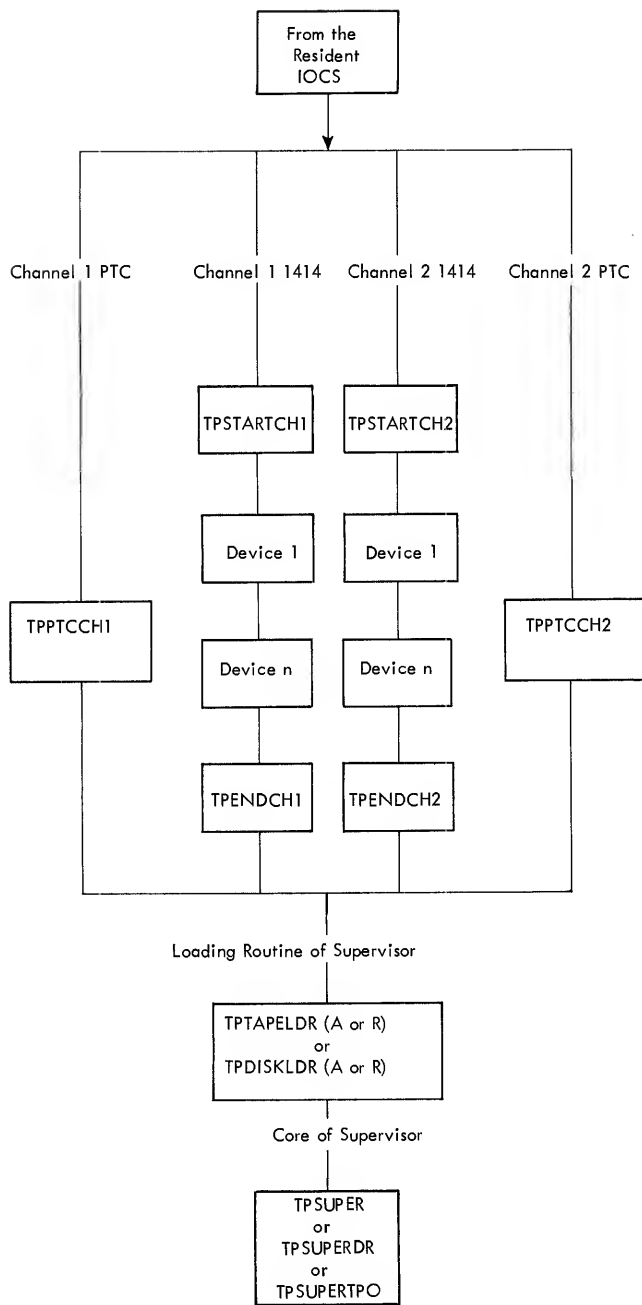
Figure 12. Sequence of Supervisor's Modules

lines are based on device type (1414 or PTC) and channel number. The following rules of sequence are illustrated by Figure 12:

1. Modules for 1414 devices must be separated by channel.

2. The first module for channel-1 1414 devices must be TPSTARTCH1.

3. The specific modules for the installation's channel-1 1414 devices must immediately follow TPSTARTCH1.

4. The specific modules for channel-1 1414 devices must be immediately followed by TPENDCH1.

5. Rules 2-4 apply also to channel-2 1414 devices.

TPDIR Macro-Instruction

The TPDIR macro-instruction provides the Supervisor with the necessary information to reserve sufficient core storage for loading the TP Directory. It produces a module with the name TPDIRECTRY. This macro-instruction must be included by the user at System Generation in conjunction with the Monitor and IOCS macro-instructions.

Figure 13 is an illustration of the coding format for the TPDIR macro-instruction. The operands are defined as follows:

xxx   The total number of TP programs residing on the TP Library.

yyy   The maximum number of TP programs that will reside in core storage at any one time. (Even in cases where the operand is "1, 1", this macro-instruction must be included at System Generation.)

Figure 13. TPDIR Macro-Instruction Format

Generation of the Executive

The user must include the Executive when specifying modules for the TP complex. It can be located anywhere in the TP complex except between device modules for a given channel. The name used on the TITLE card for the Executive must be TPEXEC.

Generation of the TP Library

Because an installation's TP Library may be in either absolute or relocatable format and may reside on either tape or disk, four TP Library Generators are provided for the generation of TP Library files. The necessary Generator(s) must be incorporated into the installation's SOF at System Generation (see the publication, *System Generation*). The generators for absolute-format TP Library files must be placed on the SOF in absolute format.

A Library Generator performs the following functions:
1. Builds a TP Library Directory.
2. Creates records of the installation's TP programs.
3. Places the TP Library, consisting of the Directory and the installation's TP programs, on the tape unit or disk tracks assigned as the TP Library file (MLT).

If the user reserves an area for TP programs, this area is bounded by /KER/ and /MKR/, as found in the Linkage Loader output from System Generation.

TP Library Generators

TPATLIBGEN — *Absolute Tape Library Generator:* The following tape assignments are required for using this Generator:

    MW1 — Work file (for Linkage Loader)
    MJB — Job file
    MW2 — Work file (for Directory)
    MR0 — Work file (for Directory)
    MLT — TP Library file

Figure 14 illustrates the control-card configuration required for generation of a tape library, in absolute format.

TPADLIBGEN — *Absolute Disk Library Generator:* The following tape assignments are required for this Generator:

    MR2   — Reserve file (for updated directory)
    MW3   — Work file (for TP Library)

The following disk assignments are required for this Generator:

    MR1   — Work file (basic directory)
    MLT   — TP Library file
    MJB   — Job file

The control cards for TPADLIBGEN follow the sequence outlined for TPATLIBGEN except for the ASGN cards and the name of the Generator (see Figure 14).

When the TP Library is generated, the control card sequence follows that of Figure 14, with two exceptions:

1. For LINKLOADTD, JOB file must be assigned to disk; for LINKLOADDT, JOB file must be assigned to tape.

2. EXEQ LINKLOAD is replaced by either EXEQ LINKLOADDT or EXEQ LINKLOADTD.
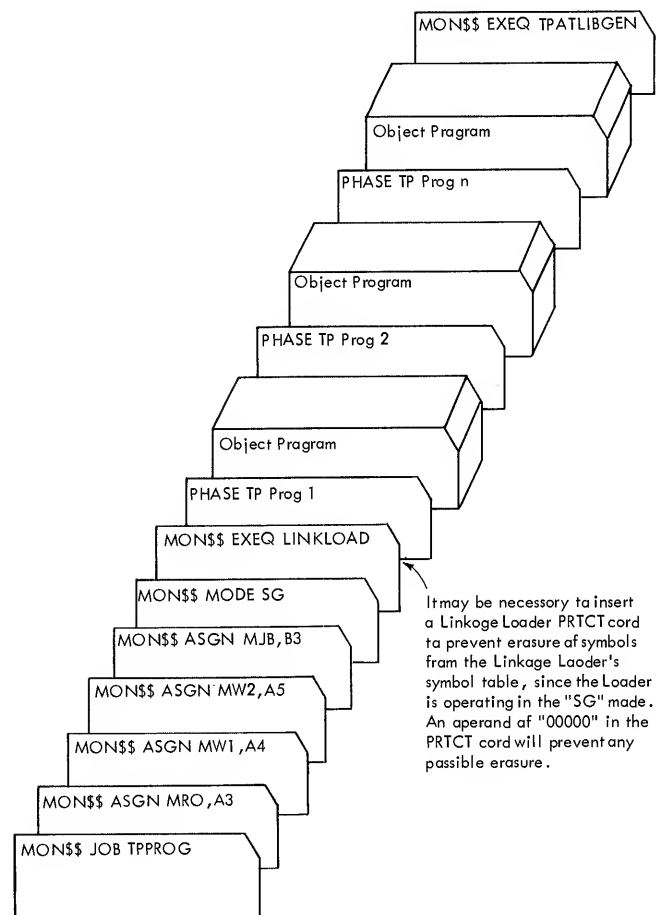
Figure 14. TPATLIBGEN Control Card Configuration

TPRTLIBGEN — *Relocatable Tape Library Generator:* Creation of a relocatable TP Library requires two passes. Pass 1 creates a special relocatable deck from the installation's TP programs entered on the Standard Input Unit. Pass 2 creates a TP Library, in relocatable format, and places it on the tape unit assigned to the system symbol /MLT/.

Figure 15 illustrates the control card configuration for TPRTLIBGEN.

Pass 1 employs a special Linkage Loader control card (OUTPUT), punched in the operation field, that creates special relocatable decks for generation of a relocatable TP Library. This Linkage Loader control card causes the Linkage Loader to resolve system symbols and linkage symbols.

TPRDLIBGEN — *Relocatable Disk Library Generator:* The control cards for TPRDLIBGEN follow the sequence outlined for TPRTLIBGEN except that assignments are made for disk (See Figure 15.)

PASS 1

MON$$ JOB NEXT
Object TP Prog n
BASE1 *+X00
TITLE Card
PHASE TP Prog n
Object TP Prog 2
BASE1 *+X00
TITLE Card
PHASE TP Prog 2
Object TP Prog 1
BASE1 *+X00
TITLE Card
PHASE TP Prog 1
OUTPT
MON$$ EXEQ LINKLOAD
MON$$ ASGN MJB,B3
MON$$ JOB TPRTHBGEN

PASS 2

MON$$ JOB NEXT
Object TP Prog n from SPU
Object TP Prog 2 from SPU
Object TP Prog 1 from SPU
MON$$ EXEQ TPRTLIBGEN
MON$$ ASGN MJB,B3
MON$$ ASGN MR2,A4
MON$$ ASGN MLT,B1
MON$$ ASGN MR1,A5
MON$$ JOB TPRTLIBGEN

Figure 15. TPRTLIBGEN Control Card Configuration

Linkage Loader creates a disk JOB file from a disk SOF, and a tape JOB file from a tape SOF. In order for an installation with a tape-oriented System Monitor to create a disk absolute TP Library and, conversely, for an installation with a disk-oriented System Monitor to create a tape absolute TP Library, two create packages for special Linkage Loaders are provided:

1. LINKLOADDT — Creates a tape JOB file for generation of a tape absolute TP Library with a disk-oriented System Monitor.

2. LINKLOADTD — Creates a disk JOB file for generation of a disk absolute TP Library with a tape-oriented System Monitor.

Figure 16 illustrates the required control cards for incorporating this option into the installation SOF at System Generation.

Label	Operation	OPERAN
6 15	16 20	21 25 30 35 40 45
M.O.N.$.$.	E.X.E.Q	S.G.1
	C.R.E.A.T	L.I.N.K.L.O.A.D.D.T. (.o.r. L.I.N.K.L.O.A.D.T.D.)
M.O.N.$.$.	E.X.E.Q	L.I.N.K.L.O.A.D.
	I.N.P.U.T	M.W.2.

Figure 16.   System Generation Sequence for LINKLOADDT(TD)

For the installation that does not wish to process main-line and TP programs simultaneously, a special Resident Monitor can be constructed that will perform the following:

1. Reduce the size of Resident Monitor to provide more core storage for processing TP programs.

2. Provide a waiting loop to serve as the main-line program while the TP complex is open.

3. Allow main-line processing *until* the TP complex is opened.

This special Resident Monitor is divided into two sections. The first, residing directly below the Supervisor in core storage, contains the modules needed to support the Supervisor's functions. The second, residing directly above the Supervisor in core storage, contains the modules needed to support processing of main-line programs, only. This latter section can be overlaid with TP programs when necessary.

Figure 17 illustrates the comparison between core-storage configurations with and without the special Resident Monitor.
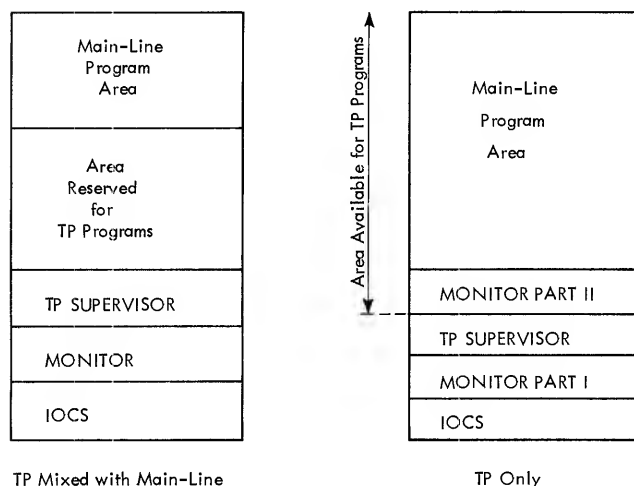
Figure 17. Comparison of Core-Storage Layouts

To establish a Resident Monitor for TP only, the user must perform the following steps during System Generation:

1. Insert the TPONLY parameter into the Monitor definitions. (See the publication, *System Generation.*)

2. After calling the normal IOCS and Monitor modules and the appropriate Tele-Processing device modules, the user must:

    a. Insert the Executive.

    b. Insert a CALLN TPDIRECTRY for the inclusion of the TP Directory module.

    c. Insert a CALLN for the desired TP program loader.

    d. Insert a CALLN TPSUPERTPO to incorporate the Supervisor for TP Only.

3. The user now includes the remaining control cards for the completion of System Generation.

After Generation, the system operates as follows:

1. Monitor is loaded and initialized.

2. Main-line programs are executed (i.e., loading the Data Control Package into the PTC, building a TP Library, etc.).

3. When main-line programs are completed, the special TP AONLY control card (Figure 18) is read, a halt is placed at location 00001, and control is given to the waiting loop in the Supervisor. (/TPB/ now reflects the *new* lower boundary for TP programs.)

4. *Using the console,* the operator opens the TP complex (see the section, "Initialization of the TP Complex").

5. As directed by the Executive, the TP programs are loaded into core storage between the end of the Supervisor and the end of core storage.

6. Whenever the Supervisor determines that no input is available for processing by a TP program, control is returned to the waiting loop in the Supervisor.

Figure 18. TP AONLY Control Card Format

Appendix: Summary of Communication Symbols

The following summary is provided to enable the programmer to quickly determine the correct symbols for particular linkages between various elements of the TP Complex. Linkages other than those specifically required between the Supervisor, Executive, and TP Programs can be established by a number of program techniques. For example, the Executive, because it becomes part of the Resident Monitor, can define *system* symbols to be used as reference points by the TP Programs. A word of caution concerning this technique: the Executive must not duplicate any symbols defined by other parts of the Resident Monitor into which it is incorporated.

Symbols in Supervisor

/TS1/ — Contains address of current input area.
/TS2/ — Contains address of output area with write-error.
/T03/ — Entry to release input area.
/T04/ — Entry to release input area, followed by branch to TP Program's close routine.
/T05/ — Entry to call *another* TP Program for current input.
/T10/ — Entry to output routine for 1009 on channel 1.
/T11/ — Entry to output routine for 1014, adapter 0, on channel 1.
/T12/ — Entry to output routine for 1014, adapter 1, on channel 1.
/T13/ — Entry to output routine for telegraph, adapter 0, on channel 1.
/T14/ — Entry to output routine for telegraph, adapter 1, on channel 1.
/T15/ — Entry to output routine for telegraph, adapter 2, on channel 1.
/T20/ — Entry to output routine for 1009 on channel 2.
/T21/ — Entry to output routine for 1014, adapter 0, on channel 2.
/T22/ — Entry to output routine for 1014, adapter 1, on channel 2.
/T23/ — Entry to output routine for telegraph, adapter 0, on channel 2.
/T24/ — Entry to output routine for telegraph, adapter 1, on channel 2.
/T25/ — Entry to output routine for telegraph, adapter 2, on channel 2.
/T31/ — Entry to output routine for PTC on channel 1.
/T32/ — Entry to output routine for PTC on channel 2.
TP02/ — Entry to request loading and execution of a TP Program.
TP30/ — Return to Supervisor from handling of error in loading the directory or a TP Program. (See next symbol, TP31/.)
TP31/ — Contains error indicator for error in loading the directory or a TP Program.
TS99/ — Entry to request only loading of a TP Program. (Control is returned to the Executive, rather than given to the TP Program.)

Symbols in Executive

TE01/ — Supervisor branches here when input is ready for processing.
TE02/ — Supervisor branches here when an error is encountered on a write operation to a Tele-Processing device.
TE03/ — Supervisor branches here for opening functions.
TE04/ — Supervisor branches here for closing functions.
TE05/ — Supervisor branches here for closing functions for PTC unit.
TE06/ — Contains address of first input area for 1014 and/or telegraph devices.
TE07/ — Contains address of first input area for 1009 units.
TE08/ — Contains address of first input area for PTC unit.
TE10/ — Supervisor branches here when a control card for the Executive has been read.
TE11/ — Supervisor branches here when console input for the Executive has been received.
TE12/ — Contains name and origin point of the TP Program requested by the Executive to process the current input.
TE13/ — Supervisor branches here when an error occurs in the loading of the directory or a TP Program.

Symbols in Resident Monitor

(These are the symbols required by, or most directly related to, the TP Complex. The Executive and TP Programs may, of course, refer to other symbols in the Resident Monitor, in accordance with the requirements of the particular program. For these other Monitor symbols, see the publication, *System Monitor.*)

/CRD/ — Contains address of input area that has control card information for the Executive.
/KER/ — Highest location (plus one) of the total Resident Monitor; therefore, the lowest location of the area reserved for TP Programs, if any. The machine address represented by /KER/ is stored in /TPB/.
/MKR/ — Lowest location of area for main-line programs; therefore, the highest location (plus one) of the area reserved for TP Programs, if any. The machine address represented by /MKR/ is stored in /ORG/.
/ORG/ — Field in Resident Monitor's Communication Region containing the address value of /MKR/ (described above). This address value is also the Linkage Loader's *base zero* factor.
/RIQ/ — First position of input area containing console input for the Executive.
/TPB/ — Field in Resident Monitor's Communication Region containing the address value of /KER/ (described above).

Symbols in LDDCP Subprogram

TLD0/ — Entry to initialize LDDCP, and to cause console message for readying the PTC unit.
TLD1/ — Entry to cause write to the PTC unit.
TLD2/ — Entry to terminate loading, and to reset Supervisor.

Reader's Comments

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Tele-Processing Supervisor--1410-SV-964

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